Specification

AIR CONDITIONER INDOOR UNIT AND METHOD OF ASSEMBLING THE SAME

TECHNICAL FIELD

The present invention relates to an indoor unit of an air conditioner and a method for assembling the indoor unit of an air conditioner.

BACKGROUND ART

An indoor unit of an air conditioner includes a heat exchanger and a ventilation fan, and conditions indoor air by blowing heat exchanged air indoors. Lines in which refrigerant flows are connected to the heat exchanger, and heat exchange is performed between the refrigerant that flows from the line to the heat exchanger and the indoor air. The heat exchanger and the ventilation fan are often disposed on a support unit such that the heat exchanger covers the upper portion of the ventilation fan. In addition, the indoor unit of an air conditioner includes the support unit that supports the ventilation fan. Conventionally, this support unit (bottom frame assembly) is often shaped so as to extend above the ventilation fan (See Japanese Unexamined Patent Application No. 2002-195595).

It may be difficult to install the heat exchanger in situations in which the support unit described above is shaped so as to extend above the ventilation fan. In other words, in situations in which the support unit is shaped so as to extend above the ventilation fan, it will be easy for the line that is connect to the heat exchanger and the support unit to come into contact with each other when the heat exchanger is installed so as to cover the upper portion of the ventilation fan. Because of this, it will be difficult to install the heat exchanger on the support unit.

DISCLOSURE OF THE INVENTION

An object of the present invention is to provide an indoor unit of an air

conditioner in which a heat exchanger can be easily installed and a method of assembling an indoor unit of an air conditioner.

The indoor unit of an air conditioner disclosed in claim 1 includes a ventilation fan, a heat exchanger, and a support unit. The heat exchanger has an approximate inverted V-shape in cross-section, lines in which refrigerant flows that are connected thereto, and is disposed so as to cover the upper portion of the ventilation fan. The support unit supports the ventilation fan. Then, each portion of the support unit is positioned at the height of the apex of the ventilation fan or lower.

With this indoor unit of an air conditioner, each portion of the support unit is positioned at the height of the apex of the ventilation fan or lower. Then, the heat exchanger is disposed so as to cover the upper portion of the ventilation fan. Because of this, during the installation of the heat exchanger, there will be little possibility that each portion of the support unit will obstruct the lines connected to the heat exchanger. Thus, with this indoor unit of an air conditioner, the installation of the heat exchanger can be simplified.

The indoor unit for an air conditioner disclosed in claim 2 is the indoor unit of an air conditioner disclosed in claim 1, in which the heat exchanger is disposed so as to cover the front, upper and rear portions of the ventilation fan.

If a heat exchanger is disposed so as to surround the front, upper, and rear portions of a ventilation fan, the distance between the heat exchanger and the ventilation fan will be shortened, and the indoor unit of an air conditioner can be reduced in size. On the other hand, because the distance between the heat exchanger and the ventilation fan is shortened, a support unit that supports the ventilation fan will easily obstruct the lines connected to the heat exchanger.

However, with this indoor unit of an air conditioner, each portion of the support unit is positioned at the height of the apex of the ventilation fan or lower. Because of this, even if the heat exchanger is disposed so as to surround the

front, upper, and rear portions of the ventilation fan, there will be little possibility that each portion of the support unit will obstruct the lines connected to the heat exchanger during the installation of the heat exchanger. Thus, with this indoor unit of an air conditioner, a reduction in size is possible and the installation of the heat exchanger can be simplified.

The indoor unit of an air conditioner disclosed in claim 3 is the indoor unit of an air conditioner disclosed in claim 1 or 2, in which the heat exchanger is installed on the support unit on which the ventilation fan has been pre-installed.

With this indoor unit for a heat exchanger, because the heat exchanger is installed on the support unit on which the ventilation fan has already been installed, the ventilation fan will be pre-installed on the support unit before the heat exchanger is installed thereon. Then, with the ventilation fan installed on the support unit, each portion of the support unit is at the height of the apex of the ventilation fan or lower. Thus, a unit in which the ventilation fan and the support unit are combined is reduced in size, and the transport thereof will be simplified. Thus, with this indoor unit of an air conditioner, the ability to transport a unit in which the ventilation fan and the support unit are combined can be improved.

The indoor unit of an air conditioner disclosed in claim 4 is the indoor unit of an air conditioner disclosed in claim 3, which further includes an electrical component box. The electrical component box accommodates electrical components, and is supported by the support unit so as to be at the height of the apex of the ventilation fan or lower. Then, the electrical component box is installed on the support unit.

With this indoor unit for an air conditioner, the support unit, the ventilation fan, and the electrical component box can be formed into a single unit. Then, even with the electrical component box installed on the support unit, each portion of the support unit and the electrical component box are at the height of the apex

of the ventilation fan or lower. Thus, a unit in which the support unit, the ventilation fan, and the electrical component box are combined is reduced in size, and the transport thereof will be simplified. Thus, with this indoor unit of an air conditioner, the ability to transport a unit in which the ventilation fan, the electrical component box, and the support unit are combined can be improved.

The indoor unit of an air conditioner disclosed in claim 5 is the indoor unit of an air conditioner disclosed in claim 4, in which the ventilation fan has a cylindrical shape and is disposed so that a central axis is horizontal, and further includes a drive device. The drive device rotatably drives the ventilation fan, and is disposed on the same axis as the ventilation fan. Then, the electrical component box is disposed so that the strong electrical components amongst the electrical components are lined up in the axial direction with the drive device.

The strong electrical components amongst the electrical components accommodated in the electrical component box are comparatively large components. Thus, in order to achieve a compact structure so that the electrical components are at the height of the apex of the ventilation fan or lower, the disposition of the strong electrical components will be a problem.

However, with this indoor unit of an air conditioner, the ventilation fan, the drive device, and the strong electrical components are aligned in the axial direction. In other words, the ventilation fan, the drive device, and the strong electrical components are aligned in the horizontal direction. Because of this, an increase in the size of the electrical component box in the perpendicular direction can be controlled. Thus, with this indoor unit of an air conditioner, a structure can be easily achieved in which the electrical component box is at the height of the apex of the ventilation fan or lower.

The indoor unit of an air conditioner disclosed in claim 6 is the indoor unit of an air conditioner disclosed in claim 4, which further includes a drive device that rotatably drives the ventilation fan. Then, the support unit supports the

ventilation fan, the electrical component box and, the drive device from below when viewed from the front, and the lower surface thereof is formed to be flat.

With this indoor unit of an air conditioner, the support unit supports the ventilation fan, the electrical component box, and the drive device from below. Thus, each structural component can be assembled and transported in a state in which the ventilation fan, the electrical component box, and the drive device are mounted on the support unit. In addition, because the lower surface of the support unit is formed to be flat, there will be stability even if the ventilation fan, the electrical component box, and the drive device are mounted thereon, and thus transport will be simplified.

A method of assembling the indoor unit of an air conditioner disclosed in claim 7 includes a first step, a second step, and a third step. The first step is installing the ventilation fan on the support unit, in which each portion of the support unit are positioned at the height of the apex of the ventilation fan or lower when the ventilation fan is supported thereon. After the first step, the second step is installing the heat exchanger connected to the lines in which refrigerant flows, and which is disposed so as to cover the upper portion of the ventilation fan. After the second step, the third step is installing a back surface member that covers the back surface of the heat exchanger and which forms a back surface side air flow path.

In this method of assembling the indoor unit of an air conditioner, there will be little possibility of each portion of the support unit obstructing the lines that is connected to the heat exchanger when installing the heat exchanger, because each portion of the support unit is positioned at the height of the apex of the ventilation fan or lower. In addition, because the back surface member is installed after the heat exchanger is installed, there will be little possibility that the back surface member will obstruct the lines connected to the heat exchanger. Thus, with this method of assembling the indoor unit of an air conditioner, the

installation of the heat exchanger can be simplified.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an exterior view of an air conditioner.

Fig. 2 is schematic diagram of a refrigerant circuit.

Fig. 3(a) is a front view of an indoor unit.

Fig. 3(b) is a right side view of the indoor unit.

Fig. 4 is a right side view of the indoor unit with an upper casing removed.

Fig. 5 is a right side cross-sectional view of the indoor unit.

Fig. 6 is a plan view of a right side portion of the indoor unit with the upper casing removed therefrom.

Fig. 7 is a right side view of a lower unit.

Fig. 8 is a plan view of a right side portion of the lower unit.

Fig. 9 is a right side cross-sectional view of the lower unit.

Fig. 10 is a flowchart that shows a method of assembling the indoor unit.

Fig. 11(a) is a schematic diagram of the right side of the indoor unit.

Fig. 11(b) is a schematic diagram of the right side of the indoor unit according to another embodiment.

BEST MODE FOR CARRYING OUT THE INVENTION

[Overall structure of the air conditioner]

The exterior of an air conditioner in which an embodiment of the present invention has been adapted is shown in Fig 1.

The air conditioner 1 includes an indoor unit 2 that is installed on an indoor wall surface or the like, and an outdoor unit 3 that is disposed outdoors.

An indoor heat exchanger 50 is accommodated in the indoor unit 2, an outdoor heat exchanger 30 is accommodated in the outdoor unit 3, and a refrigerant circuit is formed by connecting each heat exchanger 30, 50 by means of a refrigerant line 4.

[Schematic configuration of the air conditioner refrigerant circuit]

The configuration of a refrigerant circuit of the air conditioner 1 is shown in Fig. 2. The refrigerant circuit is formed primarily of the indoor heat exchanger 50, an accumulator 31, a compressor 32, a four-way switching valve 33, an outdoor heat exchanger 30, and an electric expansion valve 34.

The indoor heat exchanger 50 that is provided in the indoor unit 2 exchanges heat with the air that it comes into contact with. In addition, a cross flow fan 71 that serves to discharge air indoors after indoor air is taken in, passed through the indoor heat exchanger 50, and heat exchange has taken place, is provided in the indoor unit 2. This cross flow fan 71 is formed into a long, narrow cylindrical shape, and is disposed so that the central axis thereof is parallel in the horizontal direction. The cross flow fan 71 is rotatably driven by means of an indoor fan motor 72 that is provided inside the indoor unit 2. The detailed structure of the indoor unit 2 will be described below.

A compressor 32, a four-way switching valve 33 that is connected to the discharge side of the compressor 32, an accumulator 31 that is connected to the intake side of the compressor 32, an outdoor heat exchanger 30 that is connected to the four-way switching valve 33, and an electric expansion valve 34 that is connected to the outdoor heat exchanger 30, are provided in the outdoor air conditioning unit 3. The electric expansion valve 34 is connected to a line 41 via a filter 35 and a liquid shut off valve 36, and is connected to one end of the indoor heat exchanger 50 via the line 41. In addition, the four way directional control valve 33 is connected to a line 42 via a gas shut off valve 37, and is connected to the other end of the indoor heat exchanger 50 via this line 42. These lines 41, 42 correspond to the refrigerant line 4 shown in Fig. 1. In addition, a propeller fan 38 that serves to discharge air outside after heat exchange with the outdoor heat exchanger 30 is provided in the outdoor unit 3. The propeller fan 38 is rotatably driven by an outdoor fan motor 39.

[Structure of the indoor unit]

A front view of the indoor unit is shown in Fig. 3(a), and a side view of the indoor unit 2 is shown in Fig. 3(b). The indoor unit 2 is rectangular in shape in the horizontal direction when viewed from the front, and has a vertical two tone color scheme when viewed from the front and from the sides.

The indoor unit 2 is formed primarily by an upper casing 6, a lower unit 7, and an indoor heat exchanger unit 5 that is accommodated in the interior of the indoor unit 2. The upper casing 6 covers the upper portion of the indoor unit 2. The lower unit 7 forms the lower portion of the indoor unit 2. The upper casing 6 and the lower unit 7 are formed into separate members, and the border between the upper casing 6 and a portion of the lower unit 7 appears as a horizontal line on the exterior of the indoor unit 2. In addition, the upper casing 6 and a portion of the lower unit 7 are different colors, and the horizontal line that is the border between the upper casing 6 and the lower unit 7 forms the vertical two color scheme.

Each structure of the indoor unit 2 will be described below.

<Indoor heat exchange unit>

As shown in Fig. 4, the indoor heat exchange unit 5 is formed by the indoor heat exchanger 50, auxiliary lines 51, an auxiliary support member 52, and the like. Note that Fig. 4 is a right side view of the indoor unit 2 with the upper casing 6 removed.

Fig. 5 shows a cross-sectional side view of the indoor unit 2.

The indoor heat exchanger 50 is installed so as to surround the front, upper, and rear portions of the cross flow fan 71, and air drawn in from intake ports 601, 611 by rotating the cross flow fan 71 passes through the indoor heat exchanger 50 to the cross flow fan 71, and heat exchange is performed with the refrigerant that passes through the interior of a heat transfer line. The indoor heat exchanger 50 is divided into four components: a first indoor heat exchanger 50a, a second indoor heat exchanger 50b, a third indoor heat exchanger 50c,

and a fourth indoor heat exchanger 50d. By connecting each of the indoor heat exchangers 50a, 50b, 50c, and 50d, the indoor heat exchanger 50 is formed so as to have an approximate inverted V-shape in cross-section whose both ends are bent downward when viewed from the sides.

Each of the indoor heat exchangers 50a, 50b, 50c, and 50d have a long plate shape in the horizontal direction. Each of the indoor heat exchangers 50a, 50b, 50c, and 50d are formed from a heat transfer line that is folded back a plurality of times at both ends thereof, and a plurality of fins having short strip shapes in which the heat transfer line is inserted. The heat transfer line is folded back by means of U-shaped heat transfer lines at both side ends of each of the indoor heat exchangers 50a, 50b, 50c, and 50d.

The upper end of the first indoor heat exchanger 50a is inclined toward the front of the indoor unit 2, and the first indoor heat exchanger 50a is disposed so as to cover the cross flow fan 71 from the upper central portion thereof to the upper rear side thereof.

The upper end of the second indoor heat exchanger 50b is inclined toward the rear of the indoor unit 2, and the second indoor heat exchanger 50b is disposed forward of the first indoor heat exchanger 50a. The upper end of the second indoor heat exchanger 50b is connected to the upper end of the first indoor heat exchanger 50a, and the first indoor heat exchanger 50a and the second indoor heat exchanger 50b are combined so as to form an inverted V shape when viewed from the sides. The second indoor heat exchanger 50b is disposed so as to cover the cross flow fan 71 from the upper central portion to the upper front side.

The third indoor heat exchanger 50c is disposed on the lower portion of the second indoor heat exchanger 50b so as to cover the front portion of the cross flow fan 71. The upper end of the third indoor heat exchanger 50c is connected at an angle to the lower end of the second indoor heat exchanger 50b,

and an obtuse angle is formed by means of the third indoor heat exchanger 50c and the second indoor heat exchanger 50b. The third indoor heat exchanger 50c is parallel with the height direction, i.e., the perpendicular direction, and is perpendicular with respect to the lower unit 7 that covers the horizontal surface of the lower portion of the indoor heat exchanger 50. In addition, the lower end of the third indoor heat exchanger 50c is the lower end of the indoor heat exchanger 50, and the lower end of the third indoor heat exchanger 50c, i.e., the lower end of the front side of the indoor heat exchanger 50, is positioned at approximately the same height as the central axis of the cross flow fan 71.

The fourth indoor heat exchanger 50d is disposed on the lower portion of the first indoor heat exchanger 50a so as to cover the rear portion of the cross flow fan 71. The upper end of the fourth indoor heat exchanger 50d is connected at an angle to the lower end of the first indoor heat exchanger 50a, and an obtuse angle is formed by means of the fourth indoor heat exchanger 50d and the first indoor heat exchanger 50a. The fourth indoor heat exchanger 50d is parallel with the height direction, and is perpendicular with respect to the lower unit 7 that covers the horizontal surface of the lower portion of the indoor heat exchanger 50. In addition, the lower end of the fourth indoor heat exchanger 50d is the lower end on the rear side of the indoor heat exchanger 50, and the lower end of the fourth indoor heat exchanger 50d, i.e., the lower end of the rear side of the indoor heat exchanger 50, is positioned at approximately the same height as the central axis of the cross flow fan 71.

The third indoor heat exchanger 50c and the fourth indoor heat exchanger 50d have the same height in the height direction, and the upper and lower ends of the third indoor heat exchanger 50c and the fourth indoor heat exchanger 50d are positioned at the same height. Thus, the lower end of the front side and the lower end of the rear side of the indoor heat exchanger 50 have the same height, and are positioned at approximately the same height as the central axis of the

cross flow fan 71. In addition, the lower ends on the front and rear sides of the indoor heat exchanger 50 extend from the lower ends on the front and rear of the inverted V shaped portion downward in the perpendicular direction to approximately the same height as the central axis of the cross flow fan 71.

The first indoor heat exchanger 50a, the second indoor heat exchanger 50b, the third indoor heat exchanger 50c, and the fourth indoor heat exchanger 50d are unitarily connected to form the indoor heat exchanger 50 by mutually fixing attachment plates that are arranged on both side ends (the ends in the vertical direction when viewed from the front). The indoor heat exchanger 50 has a cross-sectional shape that is a combination of the V inverted shaped portion that is formed by the first indoor heat exchanger 50a and the second indoor heat exchanger 50b, and the straight portions that extend downward in the perpendicular direction from the respective lower ends of the first indoor heat exchanger 50a and the second indoor heat exchanger 50b. The indoor heat exchanger 50 has a linearly symmetrical cross-sectional shape from front to back with regard to a parallel line in the perpendicular direction that passes through the apex of the inverted V shape, and the first indoor heat exchanger 50a and the second indoor heat exchanger 50b, and the third indoor heat exchanger 50c and the fourth indoor heat exchanger 50d, are symmetrical from front to back. The indoor heat exchanger 50 is formed into a cross-sectional shape that includes a front to back symmetrical inverted V shape when viewed from the sides, as noted above.

The auxiliary lines 51 connect the indoor heat exchanger 50 with the refrigerant line 4 that are on the exterior of the indoor unit 2, however, when viewed from the front, is rectangular in shape in the horizontal direction and allows refrigerant to flow back and forth between the indoor heat exchanger 50 and the outdoor heat exchanger 30. As shown in Figs. 4 and 6, the auxiliary lines 51 are connected to the heat transfer line of the indoor heat exchanger 50.

Note that Fig. 6 is a plan view of the right side portion of the indoor unit 2 with the upper casing 6 removed. The auxiliary lines 51 project out from the right side of the indoor heat exchanger 50, and pass through the space on the right side of the indoor heat exchanger 50. The auxiliary lines 51 curve toward the back surface of the indoor unit 2 after projecting out from the right side of the indoor heat exchanger 50, and the plurality of the auxiliary lines 51 are gathered together and covered by a protective tube 53. The gathered auxiliary lines 51 extend downward in the space on the right side of the indoor heat exchanger 50 along the back surface of the indoor unit 2, further curve toward the left side surface of the indoor unit 2 in the lower rear space of the indoor unit 2, and are connected to the refrigerant line 4.

An auxiliary support member 52 is provided near both side surfaces of the indoor heat exchanger 50, and as shown in Fig. 4, supports the indoor heat exchanger 50 from the inner side thereof. Because the indoor heat exchange unit 5 has an inverted V shape and opens downward, the indoor heat exchange unit 5 is placed from above on the lower unit 7 on which the cross flow fan 71 and the indoor fan motor 72 have already been installed, and is supported by the lower unit 7 via the auxiliary support member 52.

<Upper casing>

As shown in Figs. 3 and 5, the upper casing 6 forms the upper portion of the indoor unit 2, and is formed by an upper front surface 60, a top surface 61, and upper side surfaces 62, 63.

The upper front surface 60 covers the upper front side of the indoor unit 2, and covers the front of the indoor heat exchanger 50. The upper front surface 60 is formed to be substantially flat, and a stepped portion is provided on a portion thereof. A front surface intake port 601 composed of a long slit shaped opening in the longitudinal direction of the indoor unit 2 is provided in the upper surface of the stepped portion. The front surface intake port 601 is arranged

toward the top of the indoor unit 2.

The top surface 61 covers the top surface of the indoor unit 2, and covers the upper portion of the indoor heat exchanger 50. Top surface intake ports 611 composed of a plurality of slit shaped openings are provided in the top surface 61. The top surface intake ports 611 are arranged from the front side to the rear side of the top surface 61, and have a larger intake area than the front surface intake port 601. Because of this, sufficient air is also drawn in from the rear side of the top surface of the indoor unit 2.

The upper side surfaces 62, 63 cover the upper portions of the side surfaces of the indoor unit 2, and cover the side portions of the indoor heat exchanger 50. The upper side surface 62, 63 is the upper right side surface 62 and the upper side surface 63 is the upper left side surface 63, and when viewed from the front, the upper right side surface 62 is disposed on the right side of the indoor heat exchanger 50 and the upper left side surface 63 is disposed on the left side of the indoor heat exchanger 50.

In addition, the lower end of the upper casing 6 is formed horizontally, and by placing the upper casing 6 on the lower unit 7, the boundary between the upper casing 6 and the lower unit 7 will be a horizontal line, and will appear when viewed from the front and the sides of the indoor unit 2.

<Lower unit>

The lower unit 7 forms the lower portion of the indoor unit 2, and as shown in Figs. 7 and 8, the lower casing 70, the cross flow fan 71, the indoor fan motor 72, the electric component box 73, and the like are in modularized form.

[Lower casing]

The lower casing 70 is formed by a lower front surface 74, a bottom surface 75, lower side surfaces 76, 77, a support portion 78, and the like, and has a color that is different from that of the upper casing 6.

The lower front surface 74 is a component that visually appears as the

lower front surface of the indoor unit 2 when viewed from the front, and the upper end thereof is disposed so as to incline on the front of the indoor unit 2. As shown in Fig. 3(a), the upper end of the lower front surface 74 is formed horizontally, and forms a horizontal border line together with the lower end of the upper casing 6. In addition, a discharge port 741 composed of an opening along the longitudinal direction of the indoor unit 2 is arranged in the lower front surface 74. As shown in Fig. 5, the discharge port 741 communicates with a space in the interior of the support portion 78 in which the cross flow fan 71 is accommodated, and the air flow produced by the cross flow fan 71 is discharged indoors through the discharge port 741. In addition, a horizontal flap 742 that guides the air discharged indoors is arranged in the discharge port 741. The horizontal flap 742 is rotatably arranged in the center of an axis that is parallel in the longitudinal direction of the indoor unit 2, and can open and close the discharge port 741 by being rotatably driven by a flap motor (not shown in the figures).

The bottom surface 75 covers the bottom surface of the indoor unit 2, and is formed to be flat. The bottom surface 75 is disposed horizontally, and the support portion 78 is disposed on top thereof.

The lower side surfaces 76, 77 are components that visually appear as lower side surfaces of the indoor unit 2 when viewed from the sides, and cover the lower side surfaces of the indoor unit 2. The lower side surface 76 is the lower right side surface 76 and the lower side surface 77 is the lower left side surface 77, and when viewed from the front, the lower right side surface 76 is disposed on the right side of the indoor unit 2 and the lower left side surface 77 is disposed on the left side of the indoor heat exchanger 50. In addition, the upper ends of the lower side surfaces 76, 77 are formed horizontally in the same way as the lower front surface 74. With the upper casing 6 placed on the lower unit 7, the lower end of the upper casing 6, and the upper ends of the lower front

surface 74 and the lower side surfaces 76, 77 of the lower unit 7 meet to form a horizontal boundary line.

The support portion 78 is surrounded by the lower side surface 74, the bottom surface 75, and the lower side surfaces 76, 77, and the upper surface of the support portion 78 is positioned above the upper ends of the lower front surface 74 and the lower side surfaces 76, 77. The cross flow fan 71, the indoor fan motor 72, the electric component box 73, the indoor heat exchange unit 5, and the like are installed from above on the support portion 78, and the cross flow fan 71, the indoor fan motor 72, the electric component box 73, the indoor heat exchange unit 5, and the like are supported from below.

The support portion 78 supports the indoor heat exchanger 50 via the auxiliary support portion 52 of the indoor heat exchange unit 5. The upper surface of the support portion 78 is at approximately the same height as the central axis of the cross flow fan 71. As shown in Fig. 7, drain pans 781, 782 and a fan accommodation portion 787 are provided on the upper surface of the support portion 78.

The drain pans 781, 782 are components that receive water drops that are produced on the surface of the indoor heat exchanger 50 during heat exchange, and are formed from concave members that are sunken downward from the upper surface of the support portion 78. A front drain pan 781 and a rear drain pan 782 are the drain pans 781, 782, and as shown in Fig. 5, the front drain pan 781 is disposed below the third indoor heat exchanger 50c, i.e., below the front lower end of the indoor heat exchanger 50. The rear drain pan 782 is disposed below the fourth indoor heat exchanger 50d, i.e., below the rear lower end of the indoor heat exchanger 50. The front drain pan 781 and the rear drain pan 782 are disposed to interpose the cross flow fan 71 from front to rear. The front drain pan 781 and the rear drain pan 782 are positioned at approximately the same height, and the bottom surface of the front drain pan 781 and the rear drain

pan 782 are positioned lower than the height of the central axis of the cross flow fan 71, but are disposed near the lower ends of the indoor heat exchanger 50. Note that the bottom surfaces of the front drain pan 781 and the rear drain pan 782 that receive the drain water are slightly inclined toward the right side of the indoor unit 2. Then, as shown in Fig. 8, a communicating portion 783 that connects the front drain pan 781 and the rear drain pan 782 is provided on the right side portion of the support portion 78, and a water removal hole 784 which penetrates the communication portion 783 downward is arranged. As shown in Fig. 9, the water removal hole 784 communicates with the interior of a drain hose 785 that serves to discharge drain water from the drain pans 781, 782 to the exterior. The drain water that drains from the indoor heat exchanger 50 is received by the front drain pan 781 and the rear drain pan 782, is collected by the communicating portion 783, and is discharged from the water removal hole 784 to the exterior of the device via the drain hose 785.

The fan accommodation portion 787 is a portion in which the cross flow fan 71 and the fan motor 72 are accommodated, and is arranged near the center of the upper surface of the support portion 78. The fan accommodation portion 787 is formed by means of a member that is sunk downward into a semi-circular shape from the upper surface of the support portion 78, and accommodates the lower half of the cross flow fan 71 and the indoor fan motor 72. In addition, an air path that communicates with the accommodated cross flow fan 71 and the discharge port 741 is arranged in the interior of the support portion 78.

In addition, the support portion 78 includes a tongue portion 786 that projects upward from the upper surface of the support portion 78 between the rear drain pan 782 and the cross flow fan 71. The tongue portion 786 covers the rear portion of the cross flow fan 71, and the upper end of the tongue portion 786 is positioned at a somewhat lower height than the apex of the cross flow fan 71.

Although the front drain pan 781, the rear drain pan 782, and the fan accommodation portion 787 are arranged on the upper surface of the support portion 78, and the tongue portion 786 projects upward, other portions on the upper surface of the support portion 78 are formed to be flat and horizontal, and are positioned at approximately the same height as the central axis of the cross flow fan 71.

As noted above, the portion that is positioned at the highest position on the support portion 78 is the tongue portion 786, but the tongue portion 786 is positioned at the height of the apex of the cross flow fan 71 or lower. In addition, the upper surface of the support portion 78 is positioned above the upper surfaces of the lower front surface 74 and the lower side surfaces 76, 77. Because of this, each portion of the lower casing 70, including the support portion 78, is at the height of the apex of the cross flow fan 71 or lower.

Note that the back surface side of the upper surface of the support portion 78 is also at the height of the cross flow fan 71 or lower, but the portion between the top surface 61 of the upper casing 6 and the back surface side of the upper surface of the support portion 78 is closed by means of an installation plate that is installed on an indoor wall surface (refer to Fig. 5). The installation plate 8 has a length that is approximately the same as the indoor heat exchanger 50 in the longitudinal direction of the indoor unit 2, and covers the back surface side of the indoor heat exchanger 50. The installation plate 8 forms, by covering the back surface side of the indoor unit 2, together with the upper casing 6, an air path through which air that exchanges heat with the indoor heat exchanger 50 passes, especially an air path of the back surface side.

[Cross flow fan]

The cross flow fan 71 is formed into a long, narrow cylindrical shape, and is disposed so that the central axis thereof is parallel with the horizontal direction. Blades are arranged on the circumferential surface of the cross flow fan 71, and

the cross flow fan 71 will produce an air flow by rotating around the central axis. This air flow is taken in from the front surface intake port 601 and the top surface intake ports 611, and is an air flow that passes through the indoor heat exchanger 50 and is discharged indoor from the discharge port 741. The cross flow fan 71 is positioned in the approximate center of the indoor unit 2 when viewed from the sides. The cross flow fan 71 is supported by the support portion 78, and when supported, the upper half of the cross flow fan projects upward from the upper surface of the support portion 78.

[Indoor fan motor]

The indoor fan motor 72 rotatably drives the cross flow fan 71 around the central axis. The indoor fan motor 72 has a thin cylindrical shape having approximately the same diameter as the cross flow fan 71. As shown in Fig. 8, the indoor fan motor 72 is disposed in approximately the same axis as the cross flow fan 71 on the right side of the cross flow fan 71, and the indoor fan motor 72 has approximately the same height as the apex of the cross flow fan 71 when the indoor fan motor 72 installed on the support portion 78 (refer to Fig. 7).

[Electric component box]

As shown in Figs. 6 and 8, the electric component box 73 accommodates a control board 731 that serves to control the operation of the indoor unit 2. The electric component box 73 has a rectangular box shape, is disposed between the lower right side surface 76 of the lower casing 70 and the support portion 78, and is positioned on the right side of the indoor heat exchanger unit 5. The electric component box 73 is installed and supported on the right side surface of the support portion 78 to the right of the indoor fan motor 72, and can be installed on the support portion 78 before the indoor heat exchange unit 5 is installed on the lower unit 7. In addition, the electric component box 73 is disposed toward the front side, and the space to the rear of the electric component box 73 is the space noted above through which the auxiliary lines 51 of the indoor heat

exchange unit 5 pass. The electric component box 73 is disposed such that the strong electric components 732, such as the condenser, the power transistor, and the like which take up a large amount of space amongst the control components installed on the control board 731, are lined up in the axial direction with the indoor fan motor 72, and is disposed such that the indoor fan motor 72 and the electric component box 73 are behind one another when viewed from the sides. In addition, the upper surface of the electric component box 73 is positioned at approximately the same height as the apex of the indoor fan motor 72, i.e., the apex of the cross flow fan 71, when the electric component box 73 is supported on the lower casing 70.

Thus, the indoor fan motor 72, the electric component box 73, and all of the components of the lower casing 70 are positioned at the height of the apex of the cross flow fan 71 or lower when supported on the lower casing 70, and the lower unit 7 has an overall comparatively small dimensional shape in the height direction.

[Method of assembling the indoor unit]

Next, the method of assembling the indoor unit 2 will be described.

The assembly of the indoor unit 2 primarily includes the assembly S1 of the lower unit 7, the installation S2 of the indoor heat exchange unit 5, the installation S3 of the upper casing 6, and the installation S4 of the installation plate 8.

In the assembly S1 of the lower unit 7, the cross flow fan 71, the indoor fan motor 72 and the electric component box 73 are installed on the lower casing 70. With the lower casing 70, materials are used which have a color that is commonly used in mass-produced indoor units 2 for air conditioners 1. In addition, the bottom surface 75 of the lower casing 70 is formed to be flat. Thus, during assembly, this surface serves as a foundation of the lower casing 70, and other structural components will be installed thereon. The cross flow fan 71 and

the indoor fan motor 72 are installed into the fan accommodation portion 787 from above, near the center of the support portion 78 of the lower casing 70, and the lower half of the cross flow fan 71 and the indoor fan motor 72 will then be accommodated in the fan accommodation portion 787. The electric component box 73 is installed on the right side surface of the support portion 78.

Note that because the lower unit 7 is modularized, the assembly S1 of the lower unit 7 allows other steps to be separately mass produced.

In the installation S2 of the indoor heat exchange unit 5, the indoor heat exchange unit 5 is installed in the lower unit 7 that was assembled as noted above. The lower portion of the indoor heat exchange unit 5 is open, and is placed and installed onto the lower unit 7 from above so as to cover the upper half of the cross flow fan 71 that projects out from the upper surface of the support portion 78.

In the installation S3 of the upper casing 6, the upper casing 6 is placed and installed on the lower unit 7 from above. A plurality of types of the upper casing 6 having different colors are prepared, and the selected upper casing 6 will be installed on the lower unit 7. When the upper casing 6 is installed on the lower unit 7, the lower end of the upper casing 6 and the upper ends of the lower front surface 74 and the lower side surfaces 76, 77 of the lower casing 70 will be connected with each other. If the color of the selected upper casing 6 is different from the color of the lower casing 70, a two tone color design in which the colors are vertically divided as described above will be displayed on the indoor unit 2.

In the installation S4 of the installation plate 8, the installation plate 8 is installed on the back surface of the indoor unit 2. The installation plate 8 is pre-installed on an indoor wall surface, and the installation plate 8 is installed on the back surface of the indoor unit 2 by installing the indoor unit 2 assembled as described above onto the wall surface. The installation plate 8 covers the back

surface side of the indoor heat exchanger 50, and covers the portion from the back surface side of the upper surface of the support portion 78 to the top surface 61.

[Special characteristics]

[1]

With this indoor unit 2 of the air conditioner 1, the lower casing 70 is positioned at the height of the apex of the cross flow fan 71 or lower. Thus, when the indoor heat exchange unit 5 is installed in the lower unit 7, the lower casing 70 will not obstruct the auxiliary lines 51 that are connected to the indoor heat exchanger 50, and the installation of the indoor heat exchange unit 5 will be simplified.

[2]

The indoor heat exchanger 50 that forms a portion of the indoor unit 2 of the air conditioner 1 is disposed so as to surround the front, upper and rear portions of the cross flow fan 71, and the position of the indoor heat exchanger 50 is comparatively lower. Because of this, the height of the indoor unit 2 will be reduced.

In addition, because when the indoor unit of an air conditioner is reduced in size, it will be easy for the other structural components of the indoor unit to obstruct the auxiliary lines, the present invention in which the installation of the indoor heat exchange unit 5 as described above will be simplified is particularly useful.

[3]

With the indoor unit 2 of the air conditioner 1, the lower unit 7 is modularized. Thus, the assembly S1 of the lower unit 7 can be performed at a separate location from that where the final assembly of the indoor unit 2 occurs. Then, in this situation, it will be necessary to transport the pre-assembled lower unit 7 to the location where the indoor unit 2 is assembled.

With the indoor unit 2 of the air conditioner 1, the cross flow fan 71, the indoor fan motor 72, and the electric component box 73 can be transported together after being mounted on the lower casing 70. Then, each portion of the lower unit 7 will be at the height of the apex of the cross flow fan 71 or lower, and the lower unit 7 will have an overall comparatively smaller height. Thus, a reduction in the amount of space during transport is achieved, and the transport of the lower unit 7 will be simplified.

In addition, with the indoor unit 2 of the air conditioner 1, because the lower unit 7 is modularized, and electric components such as the control board 731 and the like and actuators such as the indoor fan motor 72, the flap motor (not shown in the figures), and the like are included in the lower unit 7, an electric system inspection can be performed after completion of the assembly S1 of the lower unit 7.

[4]

With the indoor unit 2 of the air conditioner 1, the cross flow fan 71, the indoor fan motor 72, and the strong electric components 732 are lined up in the axial direction parallel with the horizontal direction. Because of this, the electric component box 73 is prevented from being enlarged in the perpendicular direction due to the accommodation of the strong electrical components 732. Thus, with the indoor unit 2 of the air conditioner 1, even though the electric component box 73 has a simple, rectangular shape, a structure which has a height the same as the apex of the cross flow fan 71 or lower is made possible.

[5]

With the indoor unit 2 of the air conditioner 1, the lower casing 70 supports the cross flow fan 71, the indoor fan motor 72, the electrical component box 73, and the like from below. Thus, the cross flow fan 71, the indoor fan motor 72, and the electric component box 73 can be mounted on the lower casing and transported together. In addition, because the lower surface of the lower casing

70 is formed to be flat, stability will be present even thought the cross flow fan 71, the indoor fan motor 72, and the electric component box 73 are mounted on the lower casing 70, and thus transport will be simplified.

[6]

With the method of assembling the indoor unit 2 of the air conditioner 1, because each portion of the lower unit 7 is positioned at the height of the apex of the cross flow fan 71 or lower, each portion of the lower unit 7 will not obstruct the auxiliary lines 51 connected to the indoor heat exchanger 50 when the indoor heat exchange unit 5 is installed. In addition, because the installation plate 8 is installed on the back surface side of the indoor unit 2 after the indoor heat exchange unit 5 is installed, when the indoor heat exchange unit 5 is to be installed, there will be no members that obstruct the installation on the back side surface of the indoor unit 2. Thus, in the method of assembling the indoor unit 2 of the air conditioner 1, the installation of the indoor heat exchange unit 5 is simplified.

[Other embodiments]

[1]

In the aforementioned embodiment, the upper surface of the support portion 78 of the lower unit 7 is formed to be substantially flat. However, the upper surface of the support portion 78 does not necessarily have to be flat, so long as the height of each portion of the support portion 78 is at the height of the cross flow fan 71 or lower. In addition, the height of other portions of the lower unit 7 of the lower casing 70 and the like may be at the height of the apex of the cross flow fan 71 or lower, and is not limited to the support portion 78.

[2]

In the aforementioned embodiment, the electric component box 73 is installed on the support portion 78 before the indoor heat exchange unit 5 is installed on the lower unit 7. However, in the event that the electric component

box 73 is not included in the module of the lower unit 7, the electric component box 73 may be installed after the indoor heat exchange unit 5 is installed.

[3]

In the aforementioned embodiment, the back surface side of the indoor heat exchanger 50 is covered by the installation plate 8 installed on the wall surface of the indoor unit. However, a member separate from the installation plate 8 may be installed on the back surface side of the indoor heat exchanger 50 after the installation S2 of the indoor heat exchange unit 5.

[4]

In the aforementioned embodiment, the indoor heat exchanger 50 has a shape in cross-section which includes an inverted V shaped portion and straight portions that extend downward from the lower ends thereof. However, the indoor heat exchanger 50 may have a shape in cross-section of only an inverted V shape. With this configuration as well, the size of the indoor unit 2 can be reduced by disposing the indoor heat exchanger 50 in a comparatively low position so as to cover the front, upper and rear portions of the cross flow fan 71.

[5]

In the aforementioned embodiment, the upper casing 6 and the lower casing 70 have different colors, and the indoor unit 2 has a two tone color scheme. However, the upper casing 6 and the lower casing 70 may be the same color.

[6]

In the aforementioned embodiment, the indoor unit 2, as shown in Fig. 11(a), the upper casing 6 and the lower unit 7 are vertically separated when viewed from the exterior. However, as shown by the indoor unit 2b in Fig. 11(b), the upper casing 6b may cover the lower unit 7. With this indoor unit 2b, the upper casing 6b covers the front, upper, lower, and both side surfaces of the indoor unit 2b, and covers the front, lower, and both side surfaces of the lower

unit 7. Even with this type of indoor unit 2b, the effect of simplifying the installation of the indoor heat exchange unit 5 and the transport of the lower unit 7 will be same. Note that the upper casing 6b may cover only the front and lower surfaces of the lower unit 7 and not cover both side surfaces of the lower unit 7.

(INDUSTRIAL APPLICABILITY)

By using the indoor unit of an air conditioner according to the present invention, the heat exchanger can be easily installed because there will be little possibility that each portion of the support unit will obstruct the lines that are connected to the heat exchanger.